The CMS Physics Analysis Center - PAC

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US CMS

Program Manager

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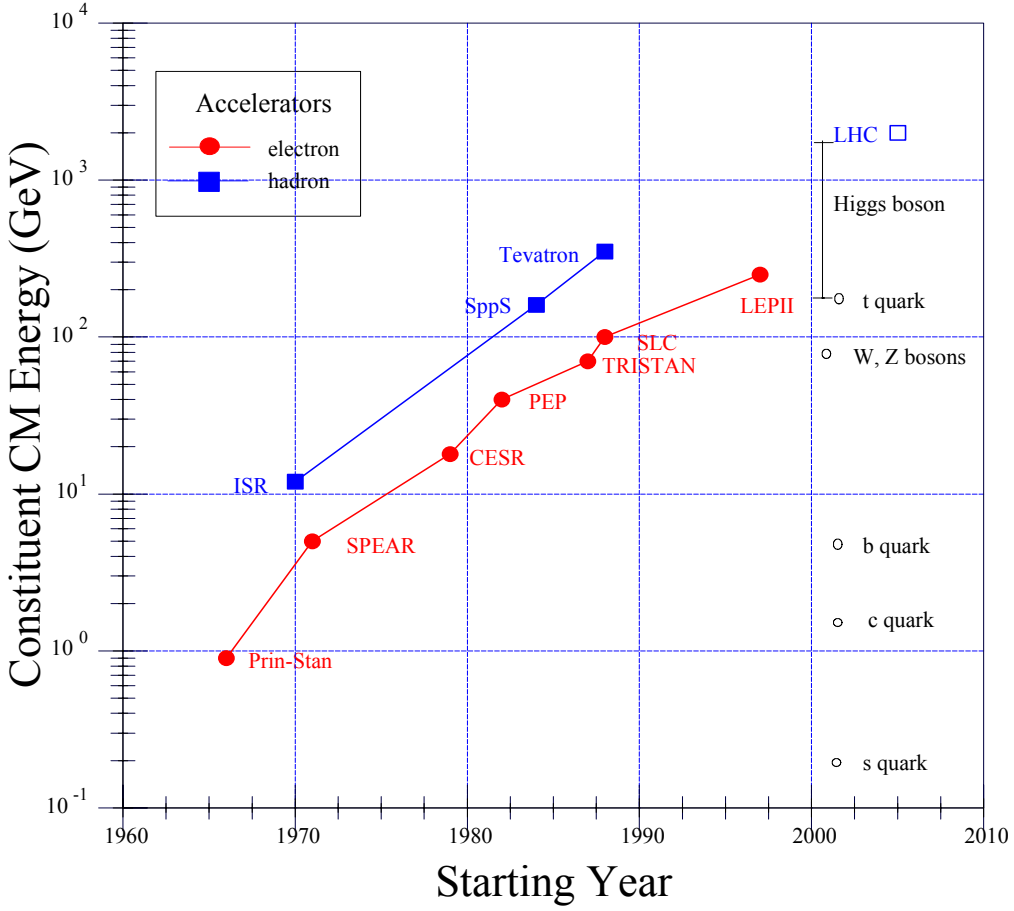
Outline

- **The Physics Plan for US CMS**
  - **Part of the RP financial planning**
  - **Took 3 years to baseline**
    - Dialogue with US CMS
    - Funding Agencies buyin
  - **Support by "host lab", Fermilab**
- **Why Now?**
  - **FNAL long range plan is developing**
  - **DC04 – boat is leaving, LHC data in 2007**
  - **Run II b and CDF/D0 evolution**
- **Infrastructure – WH11**

LHC Significance



LHC will be the first jump in C.M. energy and luminosity in 20 years. Based on the last 40 years of HEP, new phenomena are expected.

LHC Impact on US HEP

- The LHC is the first accelerator in > 20 years to advance the energy frontier.
- The LHC also advances the luminosity frontier significantly.
- These advances mean that discoveries can come almost immediately, so that we must be ready on "day one".
- The US detector efforts will be ~ complete by 2005. We are thus able to prepare well for the physics with a solid base of detector expertise.

US CMS Support

- DOE and NSF - funding 167 M$ + the operations phase at ~ 35 M$/year.
- HEPAP and Sub - panels. P5. The Facilities subcommittee. With the SLHC this program has decades of vitality.
- Fermilab base support and the Fermilab Long Range Planning Committee (J. Womersley).

Fermilab Letter on M&O

February 11, 2002

Dan Green
MS 205

Lothar Bauerdick
MS 234

Dear Dan and Lothar,

I am writing to expand upon the Fermilab role as host laboratory for US CMS and the facilities we intend to provide for the research phase of the experiment. The research program will be comprised of Software and Computing (SWC), Maintenance and Operations (M&O), and Upgrade R&D. Fermilab has taken a management oversight role from the beginning of the construction project and that role will continue in the SWC, M&O and Upgrade R&D phases.

In addition to management, Fermilab will support US CMS physics research at Fermilab. The Computing Division has provided space for the SWC effort on the ninth floor of Wilson Hall (WH). The Particle Physics Division (PPD) is pursuing a plan to make the entire eleventh floor of Wilson Hall available to US CMS. This plan requires building a new office structure in the 800 GeV Neutrino Area with a major contribution of about $2M. Wilson Hall is an excellent location for CMS because it is the center of gravity of Fermilab, with easy access to theorists, the library, seminars/colloquia and physicists working on other experiments. Most importantly, the CMS software environment would already be set up and maintained as part of the Tier 1 facility at Fermilab supported by personnel in Wilson Hall. WH-11 should accommodate the current Fermilab US CMS group on WH-6W, an additional 60 visitors, and a Virtual Control Room (VCR). The goal is to enable visitors to do physics in a coherent fashion, so as to make a major impact on CMS and LHC data analysis. Fermilab also plans to make a limited number of Guest Scientist appointments in order to seed the center with physics leaders to help develop a strong CMS physics program in the U.S.

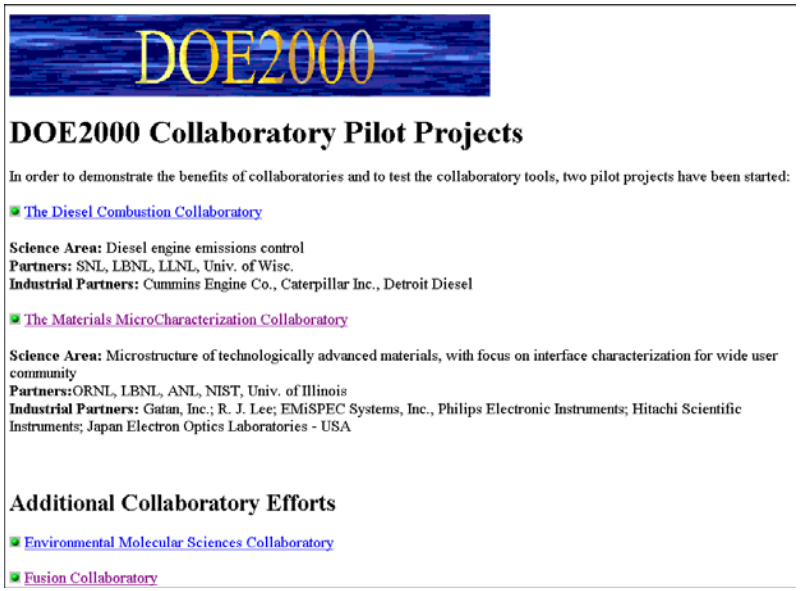
The incremental costs of setting up and operating a Physics Analysis Center at Fermilab should be borne by US CMS M&O funds. This would include the VCR to be used to debug,

FNAL is using GPP funds to site US CMS on WH11 – VCR, PAC. Support for US CMS at FNAL is strong. Occupancy in FY04 is planned.

US CMS Physics Goal

- US CMS aims to continue to be a major intellectual force within CMS in the operations and exploitation phase.
- To that end a community sized above a "critical mass" must be formed to address the Physics.
- The natural source for the growth of this community is CDF and D0 - overlap with US CMS at Fermilab in the PAC with the current expertise in the "state of the art". (now through 2008)

How to do US CMS Physics?



The funding agencies are already involved in "virtual" collaborations and laboratories. Astronomers propose a National Virtual Observatory (NVO). NSF has supported the NVO. Our model is the "collaboratory". Need state of the art teleconferencing – but also face to face interactions ➔ "critical mass".

US CMS Advantages

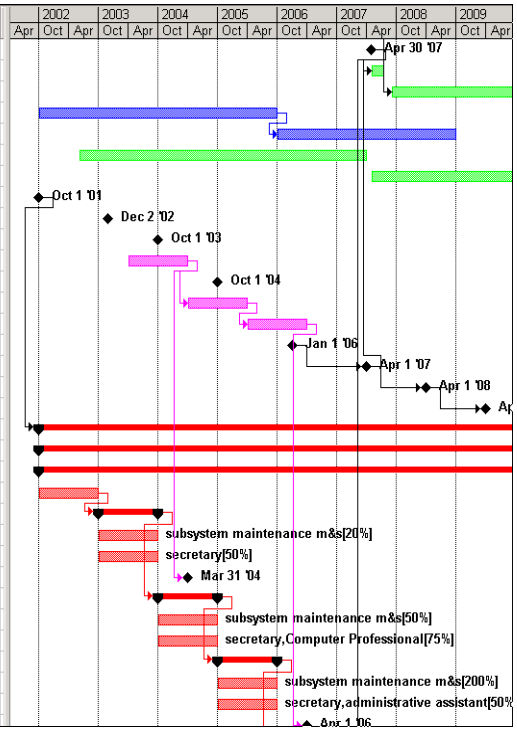
- PAC is designed as an integral part of US CMS with financial support and the support of the host lab.
- US CMS will complete detector construction ~ in 2005, leaving ~ 2-3 years to commission the detector and prepare for the physics.
- Assuming physics goes from bottoms up, US CMS is well positioned by virtue of possessing detector expertise - HCAL (Jet/Met), ME, TOB, FPIX.
- Planning for the 10 fold luminosity upgrade (the SLHC) can begin now – using strong FNAL in house facilities to design the detectors for the next decade.

Evolution of the Plan

- For > 3 years the Research Program has been being developed.
- In regards to the VCR and PAC there has been a long dialogue within the collaboration.
- In addition, inclusion of a PAC in the RP was accepted by DOE/NSF after considerable discussion.

PAC – CMS and US CMS Context, Schedule

WBS	Task Name	MSPrj Cost
18.0.20	CMS Ready	$0.00
18.0.21	CMS - Pilot Run	$0.00
18.0.22	CMS - Physics Runs	$0.00
18.0.23	US CMS Detector Project - A	$0.00
18.0.24	US CMS Detector Project - B	$0.00
18.0.25	Preoperations and Commissioning	$0.00
18.0.26	Operations	$0.00
18.0.27	Cat A Costs Begun - RRB	$0.00
18.0.28	DAQ TDR	$0.00
18.0.29	Deliver Baseline Core Software for CCS and Physics TDR	$0.00
18.0.30	Mock Data Challenge - 5%	$0.00
18.0.31	CCS TDR	$0.00
18.0.32	Mock Data Challenge - 10%	$0.00
18.0.33	Mock Data Challenge - 20%	$0.00
18.0.34	Physics TDR	$0.00
18.0.35	Computing Systems- 20% Capacity	$0.00
18.0.36	Computing Systems - 50% Capacity	$0.00
18.0.37	Computing Systems - 100% Capacity	$0.00
18.1	**CMS Category A M&O Costs**	**$12,692,000.00**
18.2	**Virtual Control Room**	**$1,994,375.00**
18.3	**Physics Analysis Centers and Collaboratory**	**$8,800,000.00**
18.3.1	FY02	$0.00
18.3.2	**FY03**	**$54,375.00**
18.3.2.1	M&S	$20,000.00
18.3.2.2	Labor	$34,375.00
18.3.3	PAC Prototype Ready - 5% Data Challenge	$0.00
18.3.4	**FY04**	**$203,125.00**
18.3.4.1	M&S	$50,000.00
18.3.4.2	Labor	$153,125.00
18.3.5	**FY05**	**$501,250.00**
18.3.5.1	M&S	$200,000.00
18.3.5.2	Labor	$301,250.00
18.3.6	PAC Installed - WH11 - 20% MDC	$0.00



In US CMS, planning is in place for a "collaboratory" or virtual laboratory. Elements are Virtual Control Room (commissioning, shifts and US accelerator community) and Physics Analysis Centers (teleconf, analysis groups). VCR/PAC will save on travel funds and provide a nucleation point for a critical mass of physicists. This support will go directly and solely to US HEP physicists.

"Build it and they will come"

- Collaboratory supported by US CMS. We need only to start. However, the PAC must be a better place to do Physics than CERN or we should not create it (and US HEP will become a European appendage).
- PAC avoids excessive travel and allows greater participation - e.g. CDF/D0 can multiplex while running at FNAL.
- There is motion on the part of CDF and D0 - because we are only 3 years away from first beam. Now is the right time to start a core effort.

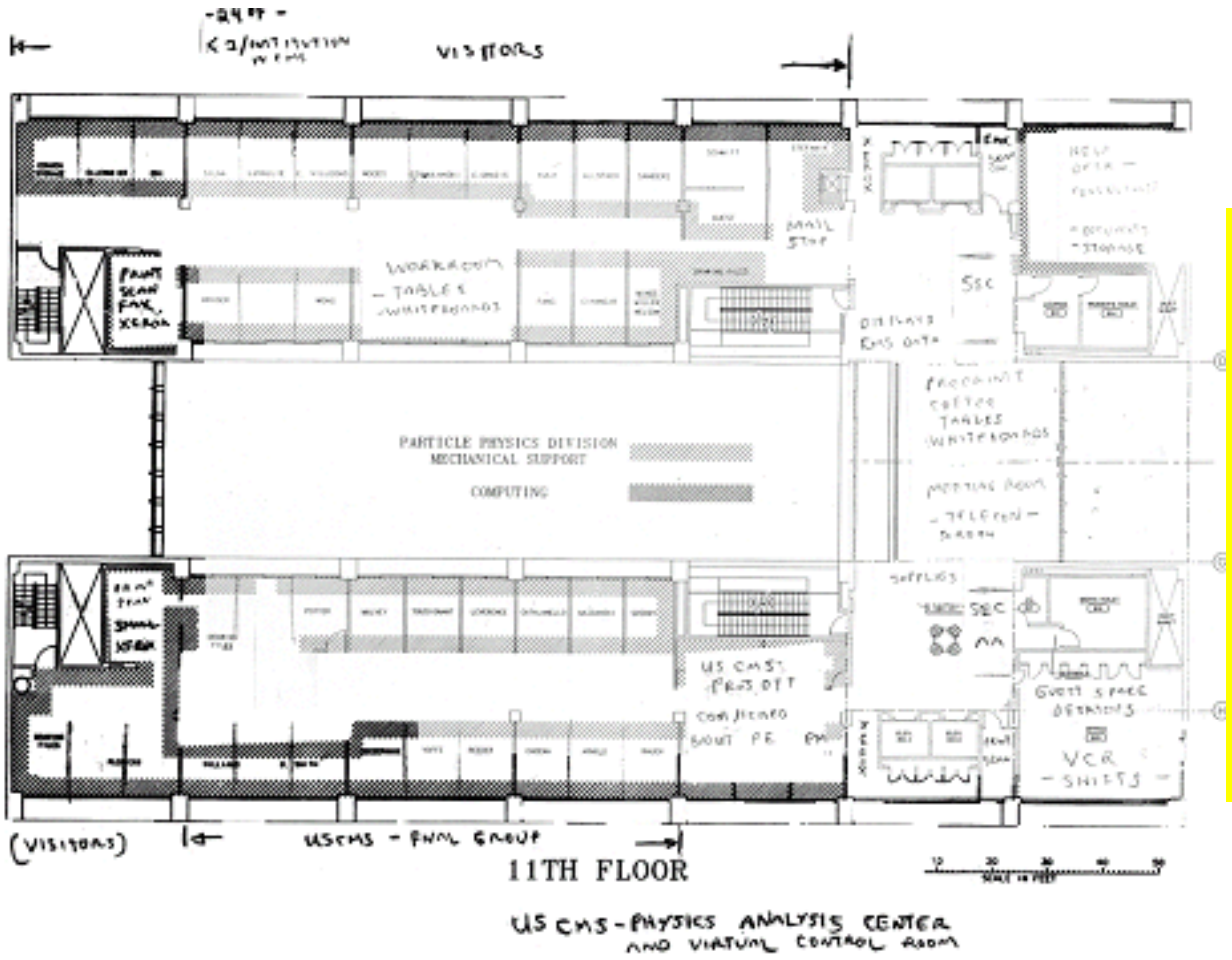
Crucial Needs

- Visitors program - support senior physicists for research to nucleate around.
- “Mixing” with CDF and D0 experts in p-p physics.
- Access to Fermilab (WH11), other theorists and phenomenological physicists.

Technical Support

- High speed Fermilab network and CERN connection. CP at CERN are in the baseline plan to facilitate data transfer. Good connectivity within US to tie US CMS together (e.g. Tier 2)
- State of the art videoconferencing
- Shared
  - data and databases
  - e logbook
  - remote ops and controls (PVSSII)
  - remote shift taking and debugging
  - workspaces, tasks

The VCR and PAC on WH11



We need liaison between the infrastructure on WH11 and the users. There should be a "bottoms up" design for the PAC.

Need space, access to Computing Division, theorists, seminars, other experimenters, PO, VCR. NSF support aimed at the Tier 2 centers.

Mundane Needs and Support

- Office space (WH11) – no more trailer trash.
- AA/Sec support
- Desktops and support
- Materials and Supplies
- Tier1 environment
- Help desk and CMS computing environment - CP.
- VCR infrastructure - CP

Points of Contact

- Heidi Schellman - LHC Users Org., Workshops on 1/4 basis?
- K. Maeshima - WH11 layout and funding, US CMS management
- L. Bauerdick, I. Fisk - Tier 1 and SWC interfaces
- S. Eno + A. Yagil - Think through initial tasks and assemble the core group.

Summary

- Planning for US CMS Physics has been a long process, because the situation is unprecedented for US HEP.
- At all points a dialogue within the US CMS collaboration has been maintained.
- The VCR and PAC are part of the baseline planning for RP and are financially secure.
- Physics research in US CMS has the Tier 1 and Tier 2 centers as points of nucleation.
- The aim is to have a “critical mass” of US physicists doing LHC physics and being in leadership positions within CMS for future decades – to help secure a future for US HEP.
- Three years is a short time to be ready for spectacular new Physics – start now!